#### (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

# (19) World Intellectual Property Organization International Bureau





#### (43) International Publication Date 19 May 2005 (19.05.2005)

#### **PCT**

## (10) International Publication Number WO 2005/045915 A1

(51) International Patent Classification<sup>7</sup>: H01L 21/311

(21) International Application Number:

PCT/JP2004/016920

(22) International Filing Date:

9 November 2004 (09.11.2004)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2003-381583 60/524,613 11 November 2003 (11.11.2003) JP 25 November 2003 (25.11.2003) US

(71) Applicant (for all designated States except US): SHOWA DENKO K.K. [JP/JP]; 13-9, Shibadaimon 1-chome, Minato-ku, Tokyo 1058518 (JP).

(72) Inventors; and

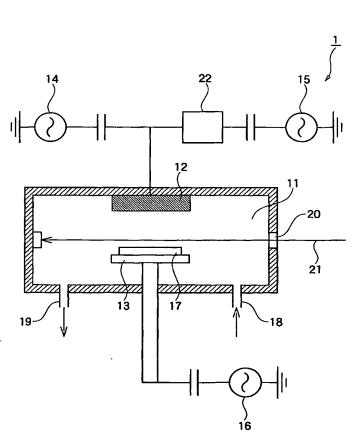
(75) Inventors/Applicants (for US only): GOTO, Toshio

[JP/JP]; 3-2110, Goshikien, Nisshin-shi, Aichi 4700105 (JP). HORI, Masaru [JP/JP]; 6-176, Fujitsuka, Nisshin-shi, Aichi 4700117 (JP). NAGAI, Mikio [JP/JP]; 1754-15, Hayashi, Komaki-shi, Aichi 4850805 (JP).

- (74) Agent: SUZUKI, Shunichiro; S.SUZUKI & ASSO-CIATES, Gotanda Yamazaki Bldg. 6F, 13-6, Nishigotanda 7-chome, Shinagawa-ku, Tokyo 1410031 (JP).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: RADICAL GENERATING METHOD, ETCHING METHOD AND APPARATUS FOR USE IN THESE METHODS



(57) Abstract: The method for generating radicals comprises: feeding F2 gas or a mixed gas of F2 gas and an inert gas into a chamber of which the inside is provided with a carbon material, supplying a carbon atom from the carbon material by applying a target bias voltage to the carbon material, and thereby generating high density radicals, wherein the ratio of CF3 radical, CF2 radical and CF radical is arbitrarily regulated by controlling the target bias voltage applied to the carbon material while measuring the infrared absorption spectrum of radicals generated inside the chamber.

### WO 2005/045915 A1



GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

#### Published:

with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.